Spring 2020

The Role of a Community-Driven, Structured Exercise Program on Children's and Adolescent's Quality of Life

Padgett Singley Powe
University of South Carolina - Columbia, padgettpowe@yahoo.com

The Role of a Community-Driven, Structured Exercise Program on Children's and Adolescent's Quality of Life

By

Padgett S. Powe

Submitted to the Faculty of the Honors College of the University of South Carolina in Partial Fulfillment of the Requirements for Graduation with Honors

May 1, 2020

Approved by:

Dr. Andrew Ortaglia

Thesis Director

Melissa Stansbury M.S.

2nd Reader

Steve Lynn, Dean

For South Carolina Honors College

Table of Contents:

I. Abstract

Childhood obesity is a long-standing epidemic in the United States as of 2020, and the problem is continuing to worsen. Childhood obesity has been shown to have many unhealthy effects, such as increasing prevalence of cardiovascular disease, depression, and social anxiety, which all can contribute to a worsened quality of life. Research suggests that summer is the most critical time period to combat childhood obesity is because children's lives are less structured over the summer, which can lead to increased unhealthy behaviors, obesity, and a decrease in quality of life. The current study, the Skybrook Swim Team Study, aimed to combat obesity, as well as increase quality of life for children and adolescents. In order to achieve this, swimmers from a nine-week community-centered, structured exercise program based on competitive swimming were surveyed at the beginning and end of the season. Differences between the survey scores were examined to gain insight into swimmers' perceived changes associated with Physical Fitness, Sense of Community, Self-Confidence, Health, and Happiness. Children and adolescents were allocated to one of six groups (9-10 Males), (11-12 Males), (13-18 Males), (9-10 Females), (11-12 Females), and (13-18 Females) in order to gain knowledge on how age and gender affect the perceived benefits obtained by participating in a community-based, structured exercise program. All six groups significantly increased their overall quality of life score. Females tended to have a larger increase in the measure of Happiness, while males showed a larger increase in the measures of Physical Fitness and Health. On average, the 9-10-year olds obtained the most benefit from the program in terms of improved quality of life, while the 13-18-year-old males showed the least improvement. In conclusion, the results of this study suggest that children and adolescents can improve their quality of life through a community-oriented, structured exercise program; however,

a child's age and sex may predispose them to obtaining different perceived benefits within the various dimensions of quality of life.

II. Introduction

The Childhood Obesity Crisis

Childhood obesity can greatly reduce a child's quality of life. Childhood obesity (body mass index at the 95th percentile or greater) in the United States has become an epidemic over the past two decades (Ogden, 2016). Public health research regarding the prevalence of childhood and adolescent obesity has shown a two-fold increase from 1988 to 2014, with an even greater increase in the percentage of children and adolescents with extreme obesity. Childhood obesity increases the prevalence of multiple risk factors for cardiovascular disease, such as accelerated atherosclerosis, dyslipidemia, and hypertension (Bridger, 2009). Obesity also increases the risk of insulin resistance and hyperinsulinemia in children, both of which are precursors to type II diabetes. The increased risk of cardiovascular disease and diabetes is worrisome because they are the first and sixth leading causes of death in the United States, respectively (CDC, 2017). The Third National Health and Examination Survey found a direct relationship between children over the age of 10 with a BMI of 85 percent or greater and a subsequent increase in the prevalence in asthma (Rodriguez, 2009). Interestingly, childhood obesity not only increases the chances of developing asthma as a child, but it also increases the chances of developing asthma later in life (Tapp, 2014). Asthma is often comorbidly associated with depression and/or generalized anxiety disorder, which subsequently lowers a person's quality of life (QoL) (Kullowatz, 2007).

Another disease, more prevalent in asthmatics and affecting more than sixty percent of obese children and adolescents, is obstructive sleep apnea, a serious sleep disorder in which breathing continuously ceases (Verhulst, 2008). Obstructive sleep apnea negatively affects

children in multiple ways: excessive daytime sleepiness, reduction in quality of life, neurological functioning, and, consequently, poor academic performance. Moreover, obstructive sleep apnea exacerbates the symptoms of cardiovascular disease (Pollock, 2016). Obesity, once believed to increase bone mass due to the fact that the bones had to withstand extra force, actually increases the risk of children suffering from bone fractures (Frost, 1997). Possible reasons for this phenomenon include elevated glucose levels inhibiting bone mass accrual (Balint, 2001) or non-differentiated mesenchymal cells becoming adipocytes rather than osteoblasts due to an increased amount of oxidized lipids (Parhami, 1997). Obesity in children and adolescents has also been directly associated with decreased self-esteem and an increased level of social anxiety and depression (Asthana, 2012). The multitude of problems associated with obesity often lead to a greatly reduced quality of life.

Combating Childhood Obesity with Positive Youth Development

Physical activity, specifically aerobic exercise (brisk exercise that elevates heart rate and promotes the circulation of oxygen through the blood), is a recommended approach to reducing the chances of developing obesity (Kim, 2017). People who only modify their diet without including physical activity often see subsequent weight regain after their weight loss. However, moderate intensity physical activity regimens are shown to be more effective at preventing weight regain after weight loss. High levels of physical activity are also shown to reduce problems associated with obesity, such as cardiovascular disease and type II diabetes (Swift, 2013). Cardiovascular exercise also strengthens a person's immune system (Karacabey, 2005). A study between a sedentary control group and a cardiovascular exercise group found that the exercise group's cortisol levels increased directly after exercise and subsequently maintained a lower cortisol level throughout the rest of the day as compared to the sedentary group. Also, the

exercise group showed a significant increase in their immunoglobulin's IgA, IgG, and IgM. The combination of decreased cortisol levels and increased immunoglobulins support overall immune health.

The benefits of better health cannot be understated because of health's vital role in determining an individual's quality of life (Yin, 2016). Aerobic exercise is also extremely beneficial for sleep by increasing sleep duration, sleep quality, and sleep efficiency while decreasing sleep onset latency, daytime dysfunction, and daytime sleepiness (Kirov, 2011). Due to sleep's critical importance in an adolescents' physical, cognitive, and psychological health, the benefits of aerobic exercise in the realm of sleep has been shown to have significant benefits on emotional and mental health, as well as quality of life (Reid, 2010).

While continuing to combat childhood obesity, structured exercise programs provide positive youth development that goes far beyond just physical activity. Structured exercise programs that emphasize goal-oriented tasks produce significantly higher cognitive improvement in participants than unstructured exercise programs, particularly in the domains of attention, concentration, and mental-flexibility (Subramanian, 2015). Also, days filled with structure are more likely to yield consistent sleep and wake cycles in which children typically go to sleep earlier and wake up earlier (Brazendale, 2017). There is suggestion that sleep duration is not as critical as sleep patterns (Olds, 2011). Children and adolescents who go to bed earlier and wake up earlier tend to be more physically active, spend less time looking at screens, and are less likely to be overweight compared to children who go to bed late and wake up late, go to bed early and wake up late, or go to bed late and wake up early. Additionally, structured exercise programs that are performed in group settings have been shown to decrease perceived stress while increasing physical, mental, and emotional health as compared to exercising individually.

The enhanced well-being in a group setting is most likely due to the social aspect and the notion that everyone is involved in a shared experience together as a cohesive unit (Yorks, 2017).

Structured exercise programs which revolve around a particular sport tend to provide more opportunity for positive youth development (Danish, 2006). Sport exercise programs are most beneficial when a coach establishes a trusting relationship with his/her athletes and transfers physical, social, and life skills, while also increasing their competency levels. Life skills learned through sport are essential to increasing the future quality of life of children and adolescents (Danish, in press). Important life skills which are learned through sport are goal setting, communicating effectively, problem solving, managing emotions, providing and receiving feedback, dealing with conflict, accepting interdependence, appreciating differences, and managing time and stress. Sport programs have also been shown to enhance character building values in athletes such as responsibility, conformity, persistence, risk taking, courage, and self-control (Kleiber, 2019). Most sports also provide levels of aerobic exercise recommended to ameliorate the childhood obesity crisis.

Another important measure in combating obesity is healthy eating. Elementary school aged children showed that structured exercise programs which incorporate games and lectures on basic healthy eating habits have a profound effect on the dietary habits of children (La Torre, 2017). Furthermore, the earlier the intervention occurs in a child's life, the more effective the intervention will be in creating healthy eating habits among children. Ultimately, children and adolescents obtain numerous benefits from a structured, group-based, sport-oriented exercise program which incorporates simple healthy eating knowledge.

Structured Days Hypothesis

Summer provides a unique window of opportunity to combat the childhood obesity crisis. Recently, a review was conducted to compare five to eleven-year-old children's typical obesogenic behavior on school days to the children's typical obesogenic behavior on weekends. The four obesogenic behaviors included were physical activity levels, amount of sedentary and/or screen time, sleep duration and/or sleep quality, and diet. Among the five to eleven-year-old children, obesogenic behaviors were significantly higher during the weekends as compared to the weekdays in eighty percent of the reviewed studies. Thus, the term "structured days hypothesis" was coined to describe that "a structured day (represented herein by a school day), defined as a pre-planned, segmented, and adult-supervised compulsory environment, plays an overall protective role for children against obesogenic behaviors, and, ultimately, prevents the occurrence of negative health-outcomes" (Brazendale, 2017). The structured days hypothesis also incorporates ideas from the "filled-time perspective", which states that time made up of positive, goal-oriented, and healthy activities cannot be filled with detrimental activities (Caldwell, 2006). For example, during school days there are multiple opportunities for physical activity, such as recess, physical-education class, and walking to and from class. Public schools also offer nutrient dense meals that must go through Food and Drug Administration approval, and schools do not typically allow for unhealthy snacking during class (Hamburg, 2014). Thus, structured days typically produce a healthier environment where children can partake in positive health behaviors.

In contrast to the structured day, unstructured weekends appear to be detrimental to children's health, and research suggests summer breaks are even more damaging. Summer break is, essentially, one extremely long weekend, which is generally devoid of structure. A study

conducted by Hippel followed 13,006 children from 846 schools from their kindergarten year through their 2nd grade year which included two summers, one between kindergarten and first grade and one between first grade and second grade. The study concluded that the prevalence of overweight children decreased throughout the school year by one to two percent. Adversely, during the two summer breaks, the prevalence of overweight children increased by approximately four percent (Hippel, 2016). An earlier study of 17,212 children from 992 schools showed that BMI increases over the summer were more than double the BMI increases throughout the school year for children in kindergarten and first grade (Hippel, 2007). Both of these large-scale studies emphasize the importance of structure for children's obesogenic behaviors.

Multiple interconnected factors contribute to BMI increases among children over the summer months. First, on average, children spend upwards of 120 more minutes per day looking at screens over the summer compared to during a typical school day (Brazendale, 2018). Research shows that increased screen time goes hand-in-hand with consumption of calorie-dense, low-nutrient foods, such as sodas, pizza, and salty snacks (Coon, 2001). Second, children typically spend less time over the summer participating in light to moderate physical activity while spending more time being sedentary (McCue, 2013). A study by Sisson compared screen time and amount of weekly physical activity to the odds ratio for being overweight among 53,532 children in the U.S. aged 6 to 17 years old. Sisson found a direct increase in the odds ratio that a child will be overweight if that child either decreases their amount of physical activity and/or increases their amount of screen time (Sisson, 2010). Third, regardless of increased screen time during the summer, children tend to have less healthy eating behaviors and more sporadic eating schedules as compared to a school day (McCue, 2013). Lastly, children tend to sleep

significantly less during the summer as compared to any other season of the year (Nixon, 2008). Decreased sleep duration is directly linked with increased likelihood of being overweight or obese in children due to the fact that sleep restrictions lead to metabolic derangement (i.e., decreased leptin, elevated ghrelin, and an increased appetite) (Taheri, 2004). Decreased sleep duration could also lead to an increased amount of time for caloric intake (Hicks, 1986). The combination of decreased levels of physical activity, increased amounts of sedentary and/or screen time, worsened sleep duration and/or sleep quality, and increased unhealthy diet choices result in detrimental health outcomes over the summer months for children and adolescents.

Aim of Study

The objective of the following study was to test how a community-driven, structured exercise program affects children's and adolescents' quality of life over summer period. It was hypothesized that children and adolescents, who are members of the structured, community-driven Skybrook Swim Team, would show an increase in quality of life. Children's and adolescents' age and sex were also considered in order expand on our understanding of how these characteristics affect changes in quality of life when participating in a sports program. The Skybrook Swim Team Study focused on changes in five dimensions of quality of life: perceived Physical Fitness, Sense of Community, Self-Confidence, Health, and Happiness during a community-oriented, structured exercise program. In order to measure swimmers' changes over the course of the program, a survey was administered to the athletes at the beginning and the end of the swim season. Since no prior survey incorporated swimming and the quality of life of children, the Skybrook Swim Team Questionnaire was created to gauge swimmers' changes in quality of life dimensions. To our knowledge, this study is the first scientific research examining the relationship between a community-driven exercise program focused on the sport of

swimming and quality of life in children and adolescents. The Skybrook Swim Team study is also unique because there are very few studies based in a community atmosphere, as many sport studies have been conducted in a school setting.

III. Methodology

Program Overview

The Skybrook Swim Team program took place in the community of Skybrook, located in Concord, North Carolina. The nine-week program started May 13th, 2019 and ended July 14th, 2019. During the previous month of April, parents registered their children to be a part of the Skybrook Swim Team. Swimmers ranged in age from 4 – 18. The only two requirements to be on the swim team were being a member of the Skybrook Swim and Racquet Club, as well as being able to complete one lap, unassisted, across the pool. The Skybrook Swim Team has been an established summer-league program for over a decade with many families returning year after year. Typically, the full team consisted of between 100-120 swimmers, as well as four coaches.

All of the children were from the neighborhoods of Skybrook or Skybrook North, middle to upper class neighborhoods of single-family homes. As per the University of South Carolina's Honors College, all procedures were deemed to be ethical, and approval from the Internal Review Board was not required. However, parents were informed about the Skybrook Swim Team Questionnaire and given the opportunity to decline on behalf of their child. No parents requested that their child not take part in the questionnaire.

How the Program was Structured

The Skybrook Swim Team's program was structured by age groups, so that each group was provided with age-appropriate workouts. For example, nine-year-old swimmers would be unable to keep up with an eighteen-year-old swimmer. The three groups who participated in the

research were the 9-10-year-old group, 11-12-year-old group, and the 13-18-year-old group. Each group practiced for one hour, four days a week (Monday, Tuesday, Wednesday, and Thursday). The season workout schedule is described below in Table 1. Practices were held in the evening Monday-Thursday from May 13th through June 9th. From June 10th through July 14th Monday, Tuesday, and Wednesday practices were held in the morning, while Wednesday practices remained in the evening.

Table 1 – Skybrook Swim Practice Schedule

Evening Practice Times		**Morning Practice Times**	
9-10 Group	6:00-7:00 p.m.	9-10 Group	9:30-10:30 a.m.
11 & up Group	7:00-8:00 p.m.	11 & up Group	10:30-11:30 a.m.

The fundamental skills covered, and the overall structure of practice were the same across each group for any given day, but the intensity was modified to maintain an age-appropriate intensity for all groups. The beginning of each practice started with 5-10 minutes of community time in which individuals became more acclimated with one another. Community time was incorporated to further the sense of community between teammates, to allow practices to be more enjoyable, and to further the individual's sense of belonging within the program. On Thursdays, community time was replaced with nutritional education sessions delivered by the coaches that encouraged healthy dietary habits among the children and adolescents. The last 30 minutes of practice on Thursdays incorporated swim-related games, which further increased a sense of community while also developing vital swim skills.

Skybrook Swim Team is part of the Triad Swim League, which consists of five teams. During the time of the study there were six in-season swim meets and one championship meet. In-season swim meets consisted of one swim team competing against one other swim team and

took place at one of the team's community pools. The championship meet consisted of all five swim teams, which competed at a larger venue not run by any of the teams. Practice ideology and structure across the nine-week season are outlined below in four main parts (Weeks 1-2, Weeks 3-4, Weeks 5-7, and Weeks 8-9).

Weeks: 1-2

The Skybrook Swim Team traditionally has a large number of swimmers who participate in the program each summer, but who do not swim during the school year. Due to the long break from the water that many swimmers went through over the past year, the first two weeks of practice were geared towards reacclimating swimmers to the water. Practices focused on the strokes of freestyle and backstroke. Multiple drills were incorporated to enhance both the swimmer's learning of the stroke, as well as their stroke technique. Freestyle drills included fist drill, high-elbow drill, fingertip drag, and perfect technique. Fist drill helped the swimmer understand the importance of pulling with the forearm as well as the hand. High-elbow and fingertip drag drills taught proper arm positioning prior to stroke entry, proper upper body rotation, and the importance of body alignment. Lastly, perfect technique drill had the swimmers bring together the previous drills into one refined stroke. During perfect technique drills, coaches would provide augmented feedback to help swimmers understand what they were doing well and what aspects of their strokes could be improved. Instructions were short, clear, and concise in order to maximize practice time while still transmitting important knowledge and information.

The first step in teaching backstroke instructed swimmers to begin on their backs and work to maintain a tight core while performing hip-driven flutter kicks. A kick board was used for assistance as necessary, providing buoyancy if a swimmer was unable to stay above water. Next, simple backstroke drills were incorporated, such as head-lead side balance drill, pause

drill, straight forehead drill, and one-arm drill. The combination of drills worked on maintaining a proper head-body alignment while keeping a tight stroke which relied heavily on rotation. Swimmers worked on underwater undulations for both freestyle and backstroke, as well as starts and finishes. The importance of "stroke count" was emphasized to the swimmers for backstroke.

The most important part of the first week of practice was building a strong sense of community. Coaches were required to learn all of the swimmers' names and swimmers were encouraged to communicate with all their fellow swimmers. During the first two weeks, swimmers were presented a "Question of the Day" in which all swimmers would answer a question by starting with "My name is …. and I ….". Questions generally ranged from "Where on earth would you want to go if you could go anywhere?" or "What superpower would you want and why?". The questions allowed swimmers to engage with each other on topics they were interested in to foster a greater sense of community.

Week: 3-4

During weeks three and four, swimmers learned butterfly and breaststroke. Because of the increased difficulty of butterfly and breaststroke, swimmers were instructed in techniques for both strokes by coach demonstration and auditory explanation. In general, one coach would perform the desired drill and/or activity while another coach verbally explained to the swimmers how to perform the drill.

For butterfly, swimmers started by learning to kick from the midback with an undulation movement while holding onto a kickboard. Swimmers progressed to kicking on their side, as well as kicking in a streamline. After kicking, swimmers were introduced to the Superman drill and Biondi drill where swimmers focused on arm and head placements, as well as the dolphin-like movement of the stroke. Next, one-arm freestyle drill was connected with butterfly kick and

subsequently turned into one-arm butterfly. The 2-2-2 and 1-pull 4-kick drills were also used to gain knowledge on the butterfly stroke.

For breaststroke, swimmers were introduced to the stroke in pieces. First, the coaches taught frog-like kick on land and subsequently in the water with a kick board. Emphasis was put on pointing the toes outwards, as well as having both feet synchronized. Next, swimmers learned the breaststroke pull by lining up and lying down next to the pool's edge. Swimmers placed their chests on the edge of the pool deck with head and arms over the water. Swimmers practiced the breastroke pull using the pool wall as a barrier so that swimmers could not pull past their chest level, as well as learn the basic pattern of the semi-circular movement. Finally, breaststroke arms were combined with legs while adding an important glide portion to the stroke. Swimmers were subsequently taught the timing of the stroke with the pull being first, then kick originating during the recovery of the pull, and the glide following the kick. Drills such as breaststroke arms with free or fly kick, 2-up 2-down, and 1 pull 2-kicks were also used.

Weeks three and four also saw an increase in practice intensity. Groups were split up during the main sets of practice in order to cater to individual skill levels (Table 2). Individuals were placed into three separate groups (novice, intermediate, and advanced) based on the coach's decision. Individuals could also move up and down groups based on individual progress. Higher level groups typically had shorter time intervals between repetitions and more overall yardage.

Table 2 – Sample Practice Based on Skill Level

	Reps x Yards	Time Interval
Novice	6x25	1:00
Intermediate	8x25	:50
Advanced	10x25	:40

*Table 2 is an example of how a simple set could be adjusted to adhere to different skill levels.

Increased endurance was the biggest goal during weeks three and four. The children increased their aerobic capacity by implementing longer distance practices that would be appropriate for each individual's skill level. Coaches introduced dives and turns during weeks three and four. On Monday and Tuesday of week four, swimmers completed Time Trials. Time Trials were basically a mock swim meet where swimmers raced each other in the four strokes to obtain a base time. The times achieved at the trial would later be used to seed swimmers into heats and lanes for swim meets.

Coaches incorporated team building activities during "community-time" during weeks three and four. Activities such as "Simon Says", "I'm the Expert", the "Name Game", and "Two Truths One Lie" were implemented. The activities were used to further team bonding outside of the pool. Dryland exercises were also sparsely incorporated to work major muscle groups and train endurance. Exercises were incorporated in a "superset fashion" so that there would be little rest. Less rest created a more aerobic setting for dryland, which included jumping jacks, seal jacks, dynamic stretching, squats, lunges, core exercises, and burpees.

Weeks: 5-7

Swim meet competition started during the fifth week. Swim meets were scheduled on Tuesday and Thursday evenings. Beginning at 6 p.m., meets started with a half hour team warm-up followed by approximately three to four hours of competition. Swim meets were always exciting because children had the opportunity to split up into groups to hangout until their particular swim event was lining up. Swim meets were a lot of swimmer's favorite aspect about swim team. Swim meets were not only fun, but they also were excellent youth development tools for the children and adolescents. Swim meets allowed children to face adversity during competition and to practice goal setting. Children and adolescents also had the added

responsibility of making it to their race on time. Experienced coaches worked with swimmers to overcome any fears or anxieties experienced during meets. Thus, swim meets were an excellent and safe place for swimmers to practice managing their emotions and facing conflict. The combination of the pressures that children put on themselves, the competition itself, and the vast number of people made swim meets a time to practice resiliency for many swimmers.

Swim meets also helped foster a sense of community by allowing the entire team to be together at one time. Before the competition began, the coaches led the entire team in a team cheer, which was an effective way to boost team morale and foster team spirit. Children were able to step up into leadership rolls, allowing them to communicate effectively with other teammates. Examples of leadership roles were helping to lead the team cheer, leading a particular relay, or cheering on fellow teammates. Swimmers were also instructed to speak with coaches after their swim to receive feedback. Receiving and learning how to react to feedback was another skill that swimmers gained from performing at a swim meet. Swimmers were encouraged to take feedback positively and use the information to further enhance their strokes.

While also presenting the opportunity to compete, weeks five through seven also included work on all four strokes, as well as the individual medley. Extra focus was applied to turns, starts, and underwaters for each of the strokes. Cardio Sets were incorporated during these three weeks to increase each individual swimmer's overall cardiovascular endurance. Cardio Sets were done once to twice a week and required the groups to break up into novice, intermediate, and advanced subgroups. The goal of Cardio Sets was to have swimmers be more aerobically challenged than during the typical practice. Cardio Sets generally incorporated a higher number of yards with a substantial amount of the yardage being at or above 70% effort. Interval times

were decreased in order to keep the swimmers' heart rates in the aerobic zone, typically between 150-170 beats per minute or 70-80% of maximum heart rate.

Practices that did not include Cardio Sets typically had two primary components. The first component was technique work. Each day that was not a Cardio Set, coaches picked one main technique point to drive home. Technique work could range from completely breaking down all of the components of a dive off the blocks to as little as working on keeping the proper head position while breathing during the butterfly stroke. Technique work was largely based on the observation of swimmers by the coaches during their swim meets. The second component was sprint work. Specificity of training, a widely known exercise science principle, acknowledges that in order to swim fast, swimmers must practice swimming fast! Sprint work was meant to develop fast-twitch muscle fibers that were greatly required for competition. Swimmers were generally allowed to choose a stroke to focus on during sprint work. Learner input was incorporated in order to empower and further motivate the swimmers.

Finally, week five included an ice cream social for all of the swimmers, coaches, and swim team families. The purpose of the ice cream social was to enhance friendships between swimmers, and also to bring families together and establish a greater sense of community. Coaches served ice cream to everyone and played games with swimmers. Games included water basketball, slide racing, animal ball, and making whirlpools.

Weeks: 8-9

The final two weeks of the season were all about getting prepared for the championship swim meet. Cardio Sets were eliminated from practices to allow for children to have a slight taper. To achieve the taper, overall yardage at practices was decreased to allow for increased muscle hypertrophy while practice duration remained constant. Fast-twitch muscle fibers were

increasingly targeted by the inclusion of power sets and an increased number of sprints. Power sets were sets in which muscle fibers were required to go from low motor unit recruitment to high motor unit recruitment quickly. Power sets were designed to make the swimmers feel more powerful while swimming through the water. An example of a power set was having swimmers get into groups of two. One swimmer would position their body horizontally in the water, a freestyle body position, while the other swimmer grabbed the ankles of the first swimmer and positioned themselves into a superman body position. The swimmer in front would pull while the swimmer behind, who is holding the front swimmer's ankles, would kick while also resisting the front swimmer. Halfway down the lap, the back swimmer would let go of the front swimmer's ankles and the front swimmer would sprint the rest of the lap. The duo would switch positions after each repetition. Power sets could also be created by having swimmers sprint part of a lap followed by swimming easy for part of a lap.

Emphasis was given to dives and turns during the last two weeks. Dives were incorporated into most practices, and coaches watched each individual while giving constructive feedback if warranted. Swimmers were also given the option to participate in both flip turn and dive clinics instead of a normal practice. A single coach would watch each swimmer, one by one, in order to give individualized advice. Swimmers also participated in multiple relays during the last two weeks in order to practice for the championship relays. The two weeks of prior relay practice also gave the relay teams time to bond and acclimate to each other, so that each individual would be more excited to perform for their team when the time arose.

The championship meet was the climax of the season. All of the swimmers looked forward to the ultimate competition at the Triad Swim League Championship. The 2019 season saw the incorporation of a fifth team for the first time in Triad history. The championship meet

was split into a ten-year-old and younger session and an eleven-year-old and older session due to the sheer number of people. The children swam in the morning and the adolescents swam in the afternoon. The anxieties of some swimmers were heightened while other swimmers became more excited for a higher level of competition. The day was long and exhausting, but Skybrook Swim Team was able to pull out a victory by the end of the swim meet.

The Skybrook Swim Team parents hosted an end of the season banquet the day after the championship meet. The end of the year banquet provided food to every member of the Skybrook Storm community, including coaches, swimmers, and family members. The banquet also included an awards ceremony where children were given medals and ribbons for their performances in the championship meet. Some children were also given "Most Valuable Athlete" and "Most Improved" awards. Games were widely available from four square to water basketball. Overall, the banquet was a fun way to end the 2019 season.

Skybrook Swim Questionnaire

The Skybrook Swim Team Questionnaire, given to the swimmers on the Monday of the first and ninth weeks of practice, had ten questions aimed at assessing the child's or adolescent's quality of life based on five measures. The five measures were Physical Fitness, Sense of Community, Self-Confidence, Health, and Happiness, with two questions per measure. Physical Fitness was defined as strength and endurance gained through exercise. Sense of Community was defined as a feeling of belonging to the Skybrook Swim Team, as well as the belief that each individual is vital to the team as a whole. Self-Confidence was defined as confidence in oneself and in one's power and abilities. Health was defined as exercising and eating healthily in order to achieve an improved lifestyle. Happiness was defined as a general state of satisfaction and well-being. Table 3 shows which questions were assigned to each measure.

Skybrook Swim Team Questionnaire

1) I feel as if I am an important member of the Skybrook Swim Team.

1 2 3 4 5 6 7 8 9 10

2) I believe in my ability to perform well in an athletic event.

1 2 3 4 5 6 7 8 9 10

3) I believe I have enough knowledge on the four swim strokes to avoid injury.

1 2 3 4 5 6 7 8 9 10

4) I am happy with my current athletic ability.

1 2 3 4 5 6 7 8 9 10

5) I get tired easily during swim practice.

1 2 3 4 5 6 7 8 9 10

6) I have a close group of friends whom I enjoy hanging out with.

1 2 3 4 5 6 7 8 9 10

7) I am confident with my ability to exercise.

1 2 3 4 5 6 7 8 9 10

8) I have enough exercise and nutritional knowledge to stay healthy.

1 2 3 4 5 6 7 8 9 10

9) I have access to help from authority figures who want to see me succeed.

1 2 3 4 5 6 7 8 9 10

10) I generally feel happy during Skybrook practices and meets.

1 2 3 4 5 6 7 8 9 10

Table 3: QoL Measure Question Layout

QoL Measure	Q1	Q2
Physical Fitness	4	5
Sense of Community	1	9
Self-Confidence	2	7
Health	3	8
Happiness	6	10

Rationale Behind the 5 QoL Measures

(1) Physical Fitness:

Physical fitness was the focus behind the current research study. It was imperative that children felt that their physical fitness was improving throughout the swim program. Physical activity, particularly cardiorespiratory fitness, is associated directly and indirectly with enhanced mental well-being, improved physical quality of life, and improved psychological quality of life (Eddolls, 2018) . Adolescents who partake in frequent bouts of physical activity also tend to have higher self-esteem as well as less depressive symptoms (Ross, 1994). The combination of physiological and mental benefits makes "Physical Fitness" an important aspect of quality of life.

(2) Sense of Community:

Creating a sense of community was essential for the Skybrook Swim program because the team was exclusively a Skybrook community team. At Skybrook, we wanted to not only enhance the feeling of belonging for each individual swimmer, but we also wanted to do the same for their parents. A sense of belonging to a community, as well as the perception of

interconnection and interdependence with others has been shown to increase one's physical, psychological, and environmental quality of life (Gattino, 2013). The "Sense of Community" measure for quality of life in the Skybrook Swim Team Questionnaire captures the team format and implications that a community has on its individuals.

(3) Self-Confidence:

The development of confidence in one's self is vital during early childhood and adolescence due to the child's continuous navigation through the stresses of our social world (Allen, 2003). At Skybrook Swim, children interacted with each other on a daily basis and were encouraged to reach out and befriend each other. The Skybrook program incorporated a multitude of different activities which promoted adult-supervised positive social interaction. Studies show that children's quality of life is directly associated with their sense of self (Bastiaansen, 2005; Martinsen, 2016). Because of the age of the swimmers and the program's emphasis on enhancing an individual's belief in their ability to complete certain tasks, "Self-Confidence" was utilized as a measure for quality of life.

(4) Health:

A direct correlation between an individual's life satisfaction and one's health can easily be drawn. Health's role in determining a person's quality of life is so important that the Center for Disease Control (CDC) created the Health-Related Quality of Life (HRQOL), which directly examines the impact of health status on quality of life (Yin, 2016). A hallmark of the Skybrook Swim Team Study was to help children and adolescents maintain a healthy lifestyle with an adequate amount of physical fitness over the high-risk period of summer break. Because of the objective of the current study and the previous research conducted by the CDC, "Health" was a critical measure for quality of life.

(5) Happiness:

A sizeable amount of people believe that quality of life and happiness are one in the same (Kullowatz, 2007). However, present day philosophers argue that happiness is merely one aspect within quality of life. A study which looked at a large number of female college students found that happiness and quality of life are mediated by resilience, the ability to bounce back from difficult situations (Hamburg, 2014). Children, as a part of the Skybrook Swim program, have to undergo adversity throughout the entire season due to intense competition, social stresses, injuries, and other complications. Because of both happiness's association with quality of life and the mediating effect of resiliency, "Happiness" was an excellent measure for quality of life.

How Scores were Calculated

Each question of the Skybrook Swim Team Questionnaire was scored from "1" to "10". A score of "1" meant the swimmer completely disagreed with the statement and a score of "10" meant the swimmer completely agreed with the statement. A score of "1" was the lowest score for the question's measure and a score of "10" was the highest score. Reverse scoring was used for question #5, a measure of Physical Fitness, which states, "I get tired easily during swim practice". A score of a "9", meaning the swimmer highly agrees to tiring easily, would not make sense to be a high score for a high level of Physical Fitness. Thus, for question #5, lower scores equate to higher levels of Physical Fitness. For example, if a swimmer put a "2" as their score on question #5, then their score would be a "9" for calculation purposes.

Each pair of related questions had their two scores combined into a single score for each of the five quality of life measurements. Each quality of life measurement mean score from the first administered survey was compared with the second administered survey. The mean change of score was calculated and a paired t-test and multiple regression analysis were performed in

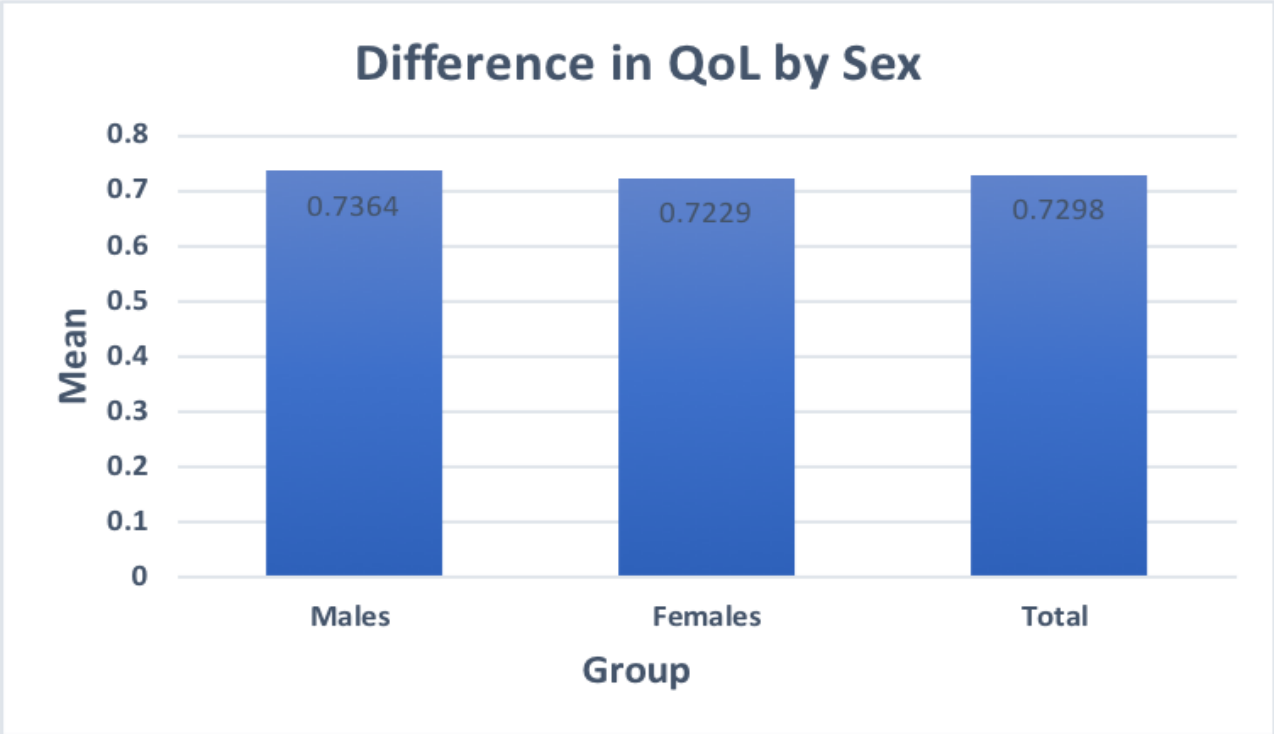
order to determine statistical significance. Statistical significance was determined by a p-value < .05. First, a T-test was performed which stratified the sample by sex. Secondly, a multiple regression analysis, stratified by sex and age-adjusted, was performed.

IV. Results

The intention of the current research study was to assess whether children and adolescents' quality of life would improve after training in a structured, community-driven exercise program. A total of 68 swimmers, 33 females and 35 males, aged 9 to 18 completed the Skybrook Swim Team Questionnaire. The questionnaire was administered on May 13th and again on July 11th. If a child was not present at either of the practices where the survey was given, then they were given the survey on the first day they returned. There were no missing questionnaires at either time point. The majority of the children in the study identified as Non-Hispanic White (75%), with 10% African-American and 15% Asian-American. The study also sampled children and adolescents from two affluent neighborhoods in which most individuals lived in middle to upper class single-family homes. Practice attendance was not mandatory, but it was strongly encouraged. Coaches noticed that practice attendance was the worst for the 13-18-year-old age group. The 11-12-year-olds had better practice attendance than the 13-18-year-olds but a worse practice attendance than the 9-10-year-olds. The trend seemed to be that practice attendance diminished as the swimmers got older.

First, gender was considered without adjusting for age groups. Data on the mean, standard deviation, t-score, and p-value are all found in the Appendix as part of Table 4: Paired T-Test Stratified by Sex.

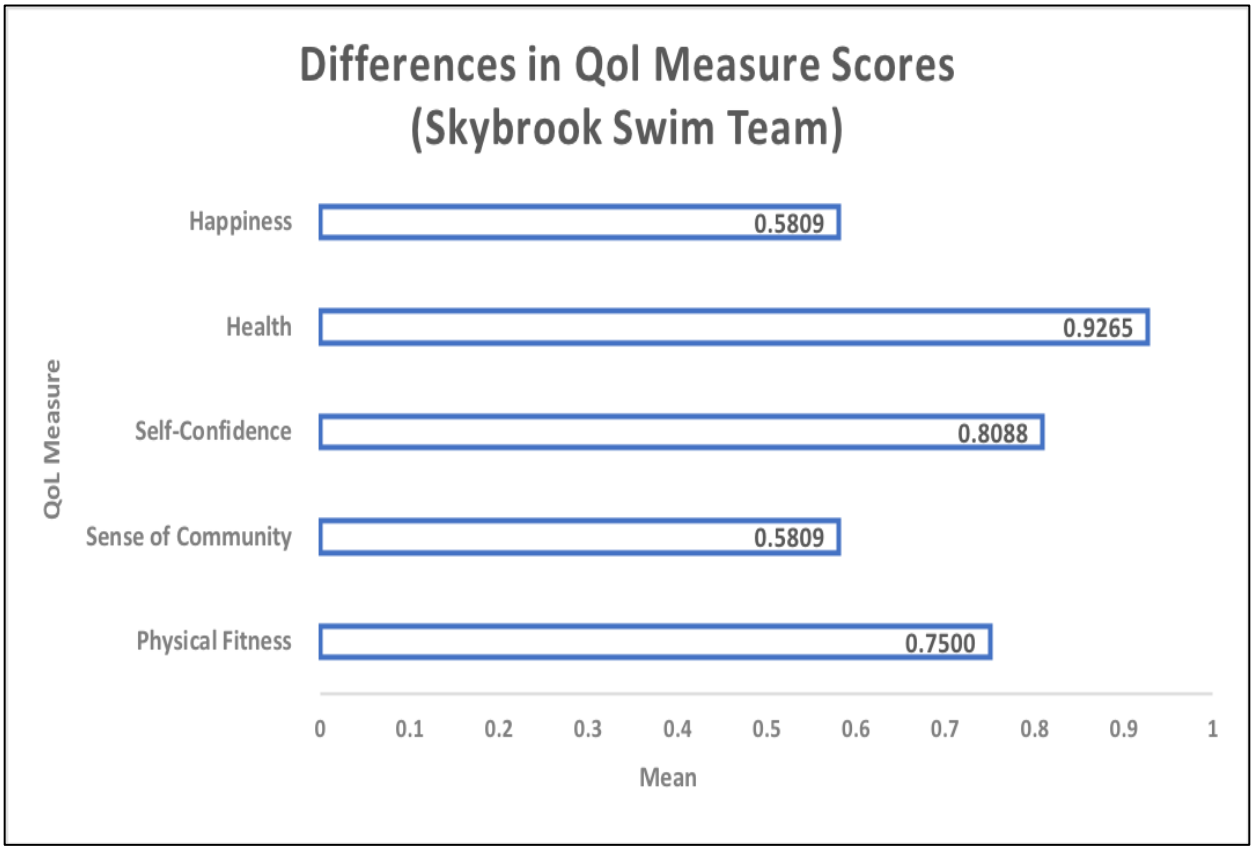
Graph 1: Difference in QoL by Sex



Graph 1 shows the mean change from the beginning of the season to the end of the season in swimmer's overall quality of life (QoL) scores by sex. Overall quality of life was calculated by averaging the scores of all five quality of life measures (Physical Activity, Sense of Community, Self-Confidence, Health, and Happiness). In Graph 1, "Total" means all of the female and male swimmers combined. On average, the swimmers of the Skybrook Swim Team saw a statistically significant overall quality of life increase of 0.7298 points. Both males and females had a statistically significant increase in their overall QoL scores (p=<0.0001 for both). Males, however, had a slightly higher increase in QoL scores as compared to females (0.0135).

Next, the changes in QoL measures over the course of the season were calculated for the entire sample, the Skybrook Swim Team.

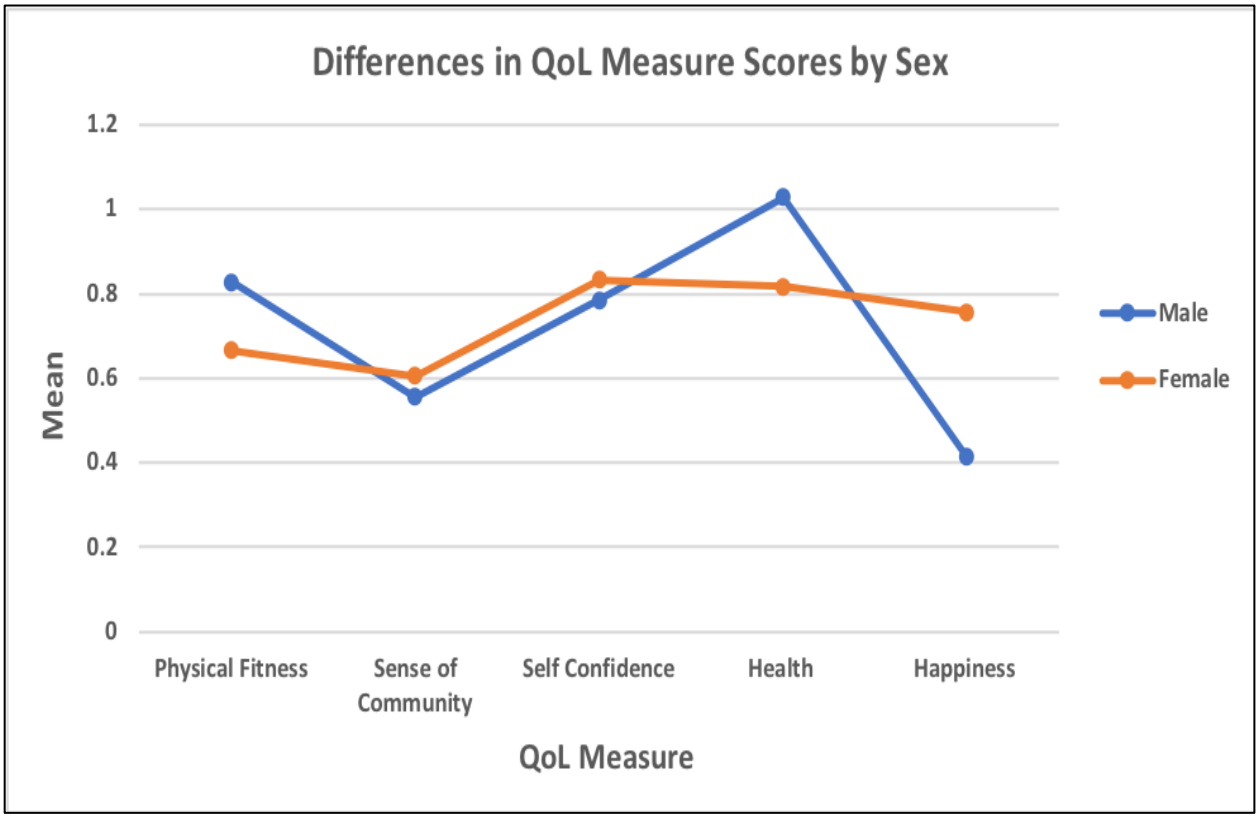
Graph 2: Differences in QoL Measure Scores (Skybrook Swim Team)



Graph 2 shows the changes in each individual QoL measure throughout the season for the entire Skybrook Swim Team population. As a team, Skybrook showed an increase among all five quality of life measures. The measures of Sense of Community and Happiness had the least overall improvement; however, the average swimmer still increased over half a point. The next greatest increase was in Physical Fitness scores which were (0.1691) points higher than both Sense of Community and Happiness. The second greatest improvement was in Self-Confidence, which had a (0.0588) point higher increase than Physical Fitness. Finally, the greatest improvement was in Health which saw a (0.1177) point higher increase than Self-Confidence.

Next, the QoL measures were stratified by sex, unadjusted for age group. In the appendix, Table 4 also provides results on QoL measures by gender.

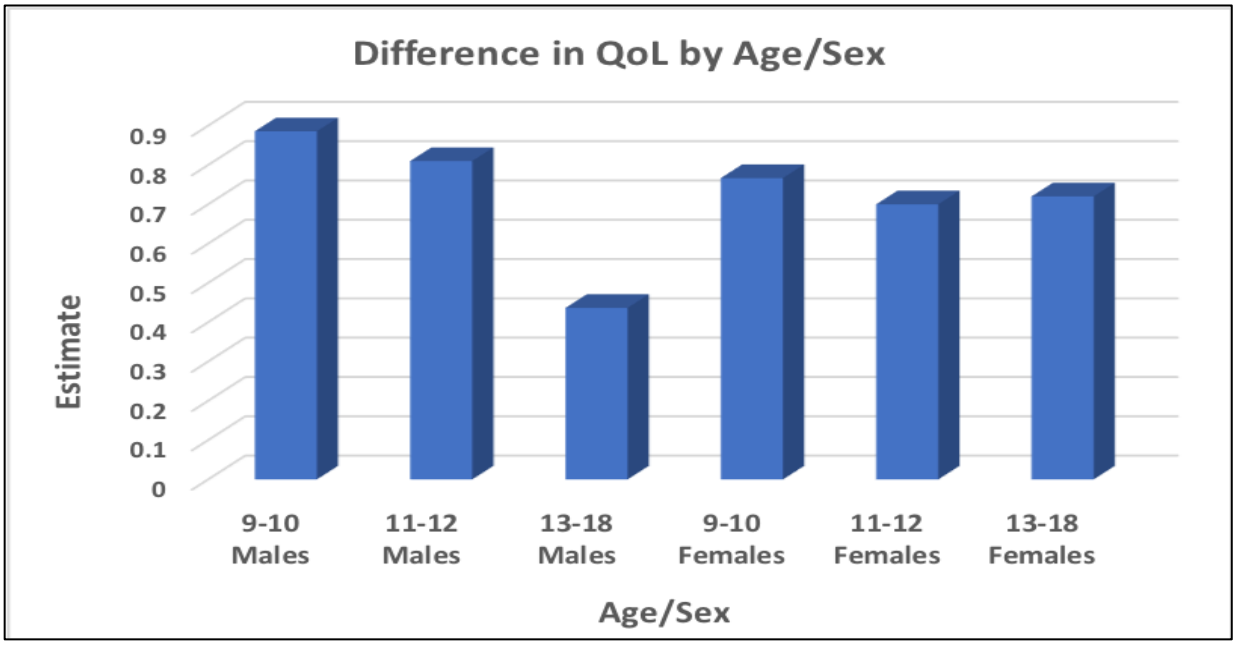
Graph 3: Differences in QoL Measure Scores by Sex



Graph 3 shows the swimmers' mean change from the beginning of the season to the end of the season for individual QoL measures based on gender. The blue line represents the average mean score for the males while the orange line represents the average mean score for the females. Females, as a whole, saw a considerably larger increase in the Happiness measure score (0.7576) as compared to males (0.4143), yet males saw a considerably larger increase in both the measure scores of Physical Fitness (0.8286) and Health (1.0286). Females, on the other hand, had a Physical Fitness score of 0.6667 and a Health score of 0.8182. The females and males had similar increases in both Sense of Community, females (0.6061); males (0.5571), and Self-Confidence, females (0.8333); males (0.7857). All of the QoL measures were statistically significantly increased for both genders except for male's Happiness score.

Next, a multiple regression, stratified by sex and age-adjusted, was performed. First, the overall QoL difference for each individual age group was calculated. In the appendix, Table 5: Multiple Regression, Stratified by Sex, Age-Adjusted (Females) and Table 6: Multiple Regression, Stratified by Sex, Age-Adjusted (Males) show the results for both the QoL changes for each individual group and the changes for the five QoL measures.

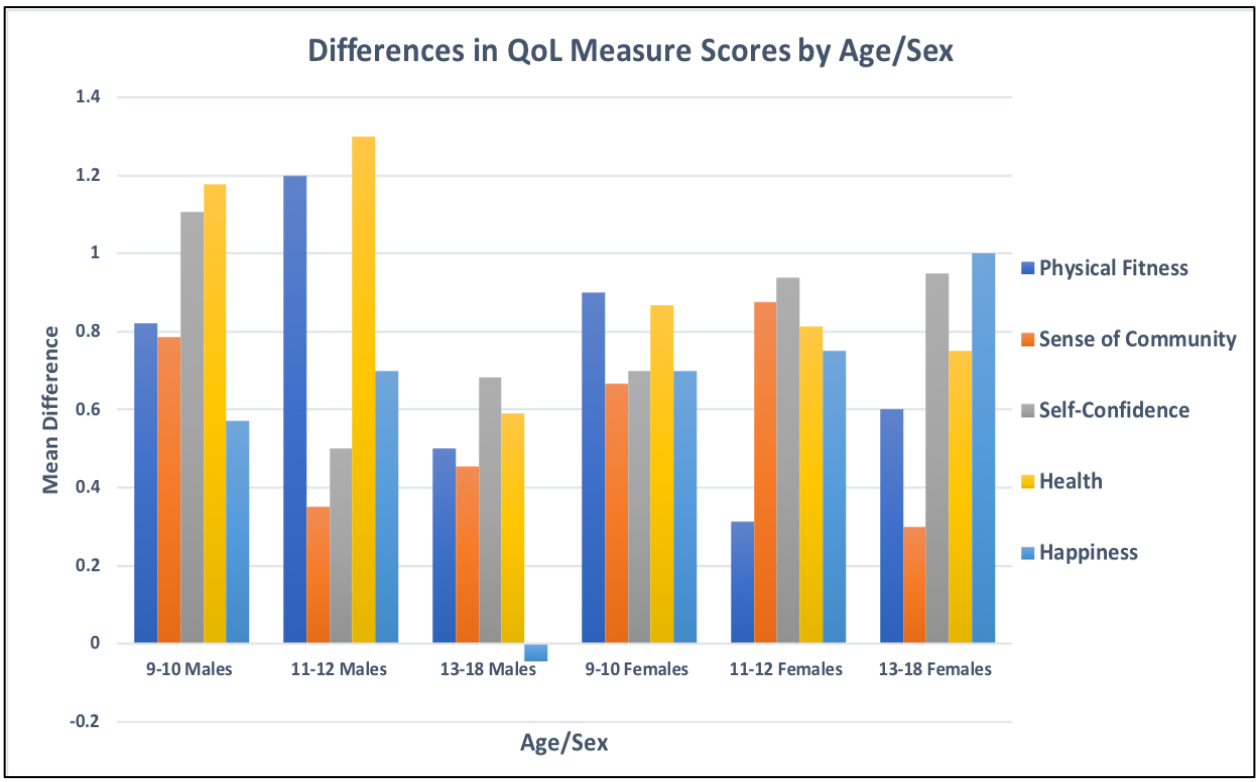
Graph 4: Difference in QoL by Age/Sex



Graph 4 depicts how each group's QoL changed over the course of the season. The six groups are 9-10 males, 11-12 males, 13-18 males, 9-10 females, 11-12 females, and 13-18 females. All six groups had a statistically significant improvement in their QoL score. The 13-18 male group had the least QoL improvement with only a 0.4364-point increase. The three female groups all had similar QoL increases with the 9-10 females having a 0.7667-point increase, 11-12 females having a 0.7000-point increase, and the 13-18 females having a 0.7200-point increase. The largest QoL increases were seen in the 9-10 male group (0.8857) and the 11-12 male group (0.8100).

Lastly, the differences in each of the five QoL measurement scores were compared by sex and adjusted for by age group. Detailed results associated with Graph 4 are available in Table 5 and Table 6.

Graph 5: Differences in QoL Measure Scores by Age/Sex



Graph 5 depicts the change for each of the individual QoL measures by sex and age group. The dark blue bar symbolizes Physical Fitness, the orange bar symbolizes Sense of Community, the grey bar symbolizes Self-Confidence, the yellow bar symbolizes Health, and the light blue bar symbolizes Happiness.

Physical Fitness scores had a much greater increase among the 9-10 females, 9-10 males, and 11-12 males with the 9-10 females improving 0.9000-points and the 9-10 males improving 0.8214-points. On the other hand, the 13-18 females had a 0.6000-point increase and the 13-18 males had a 0.5000-point increase. The 11-12 girls showed the least improvement (0.3125),

while the 11-12 boys showed the most improvement (1.2000). The increase in scores were statistically significant for the 9-10 females, 9-10 males, and 11-12 males, yet the scores were not significant for the other three groups.

As a whole, Sense of Community did not have as large of a point increase compared to the other measures. The 9-10-year-olds had the largest point increase on average for any one age group with the females increasing their score by 0.6667 and the males increasing their score by 0.7857. The 11-12 females had the largest point increase of any group (0.8750); however, the 11-12 males only had an increase of 0.3500 points. The 13-18-year-old females and males had a point increase of 0.3000 and 0.4545, respectively. The increase in scores were statistically significant for the 9-10 females and the 9-10 males, yet the other four groups' increase in scores were not significant.

Self-Confidence scores had the greatest increase among the 9-10 male group (1.1071); however, the 9-10 females saw the least improvement, 0.7000, out of all three female groups. The 11-12 groups saw a much larger point increase among the females (0.9375) as compared to the males (0.5000). The 13-18 groups saw a 0.9500-point increase among the females and a 0.6818-point increase among the males. The increase in scores were statistically significant for all three of the female groups and the 9-10 male group, yet the scores were not significant for the other two male groups.

Health score increases were similar among all three female groups with the 9-10 females increasing by 0.8667-points, the 11-12 females increasing by 0.8125-points, and the 13-18 females increasing by 0.7500-points. The 13-18 males saw a much smaller increase in Health scores (0.5909) as compared to the 9-10 males (1.1786) and the 11-12 males (1.3000). The increase in scores were statistically significant for all groups except the 13-18 males.

Happiness scores saw the least improvement among the five QoL measures. It is also important to note that the Happiness measure had the largest standard error. The 13-18 males had the only decrease of scores in the entire study with a decrease of 0.0455-points, otherwise known as an increase of -0.0455-points. On the contrary, the 13-18 females saw the largest Happiness score increase (1.0000). The 9-10 females increased their score by 0.7000, and the 9-10 males increased their scores by 0.5714. The 11-12 females had an increase of 0.5625-points, while the 11-12 males had an increase of 0.7000-points. The increase in scores were statistically significant for none of the groups.

Overall, the QoL measures of Physical Activity, Self-Confidence, and Health saw much larger point increases as compared to the QoL measures of Sense of Community and Happiness. The 9-10 age group saw the most overall improvement in QoL measure scores. On the contrary, 13-18 males had the least increase in QoL measurement scores and were the only group to have an overall decrease of any score (13-18 Male Happiness).

V. Discussion

The objective of the Skybrook Swim Team Study was to assess whether a community-driven, structured exercise program which revolves around the sport of swimming could improve children's and adolescents' quality of life, and if so, to what magnitude. Quality of life was based on the five measures: Physical Fitness, Sense of Community, Self-Confidence, Health, and Happiness. The study was designed so that quality of life could be compared among different sexes and age groups, which allowed for insights to be made about how quality of life changed among the different cohorts. The changes in overall quality of life will be discussed first, followed by each QoL measure in the order they appear within the results.

All groups demonstrated a statistically significant increase in their overall quality of life scores. On average, swimmers improved 0.7298 points as a team. Because the Skybrook Swim Team Questionnaire was scaled 1 to 10, a 0.7298-point increase equates to approximately an 8.1% increase in a swimmer's perception of their quality of life. The magnitude of improvement was also similar among both genders. Males and females both obtaining similar quality of life gains through sport participation is not a new phenomenon as it has been supported in previous studies (Kelinske, 2001). However, while sport participation increases the quality of life for both males and females, males tend to improve their quality of life because of the strength and endurance aspect of the sport, while females gain life satisfaction through social support and bonding among teammates (Valois, 2004). Interestingly, the 13-18 males showed the least amount of positive quality of life attainment through the Skybrook Swim Team program. A possible explanation could be that as youth age, the opportunity for maximal impact through sport participation decreases due to adolescents' tendency to transfer their major source of influence from supervising adults to peers (Danish, 2000). The results of adolescent's and children's changes in quality of life are encouraging. The research supports the original hypothesis and suggests that a community-oriented, properly structured exercise program in the sport of swimming can have a profoundly positive effect on children and adolescents.

The first QoL measure was Physical Fitness. All groups improved their Physical Fitness scores over the course of the season; however, only the 9-10 males, the 11-12 males, and the 9-10 females showed significant increases. Increases in perceived physical fitness may be attributed to the multitude of physical benefits associated with swimming. For example, swimming lowers blood pressure, improves vascular functioning, and improves the efficiency of both the diaphragm and the abdominals, which, in turn, substantially improves respiratory rate,

blood circulation, and the oxygenation of both the blood and the tissues (Petrescu, 2013). The countless physical and health benefits obtained through swimming improve one's endurance, strength, muscle tone, and cardio-respiratory fitness, all of which could lead to an increased Physical Fitness score. While everyone improved in Physical Fitness, males saw a larger increase in scores compared to females. A recent study, which looked at each gender's perceived physical fitness gains through a team sports program, found similar findings (Fernández, 2016). The study results suggest that females are 2.6 times more likely to perceive their physical fitness as inadequate due to physical or social anxiety and/or a negative portrayal of one's body image; however, males are only 1.2 time as likely to rate their physical fitness as inadequate for the same reasons. Furthermore, the effects of anxiety and a negative body image can be exacerbated in the sport of swimming, which could lead to lower Physical Fitness scores among females. Younger children also tended to see greater increases, on average, than their older counterparts. Younger children perceiving their physical fitness as superior, however, is not a novel concept. A previous study, which specifically looked at the correlation between sex/age and perceived physical fitness level, reported that male children perceive that they are in the greatest shape during 1st grade (approximately seven years old) (Štefan, 2019). On the other hand, female children tend to perceive their physical fitness as the best in 3rd grade (approximately nine years old). Younger children's general perception that they are in better physical shape could be one reason why younger children showed greater increases in Physical Fitness scores. Overall, the Skybrook Swim Team Study shows encouraging results, suggesting that a community-driven, properly-structured exercise program revolving around the sport of swimming can increase one's perception of their level of Physical Fitness.

Sense of Community was the second QoL measure, and its score increased among all six groups; however, sense of community scores did not increase as much as Physical Fitness, Self-Confidence, or Health. Sense of community can be a long process to foster. The Harvard Business Review found that adjusting to a new environment and developing a sense of community takes two to three months (Buote, 2016). The Skybrook Swim Team program lasted approximately two months, which is on the low end of the amount of time it takes to build a sense of community. The shorter duration of the program could be an explanation for why the Sense of Community scores did not increase as drastically as others. Interestingly, 11-12 females showed the most improvement in Sense of Community scores while 11-12 males showed the least improvement. A possible explanation of this phenomena is that females tend to want to be most involved in a team sport when they are twelve years old (Eime, 2013). On the contrary, males want to be most involved in team sports between the younger ages of nine and ten (Kumar, 2009). If older males are less likely to want to be involved, then they are also less likely to form a sense of community because the core principal for developing a sense of community is getting involved (Patriarche, 2009). A second possible explanation for 11-12 female's larger increase in Sense of Community scores could be because of female's inherent nature to gain life satisfaction through sport from social support and bonding among teammates (Valois, 2004). In terms of age, the 9-10-year-olds showed a greater increase in Sense of Community scores compared to the 13-18-year-olds. Sports do not always foster a community for everyone; in fact, it is the individual's experience of the sport and physical activity which ultimately deems whether participation is positive or negative (Garcia Bengoechea, 2001). That being said, the 13 to 18-year-old groups had the lowest practice attendance out of every group which allowed for fewer opportunities for positive social interactions. Overall, while Sense of Community did not increase as much as

other QoL measures, Sense of Community still improved among children and adolescents by participating in a community-driven, properly structured exercise program revolving around swimming.

The third QoL measure was Self-Confidence. Self-Confidence scores increased among all six groups; however, only four groups showed statistical significance. Previous research has shown that participation in sports improve self-confidence for both genders by increasing an athlete's positive identity and self-worth (Zarrett, 2009). The 9-10 males saw a greater score increase than either of the other two male groups. A possible reason young males may have a greater increase in Self-Confidence is the fact that 9-10-year-olds tend to have less experience with goal setting. Sports provide an excellent area to practice goal-accomplishment through competition because goals in sports are generally tangible, easily measured, and short-term (Danish, 2006). Younger males' lack of experience with goal setting could make the impact of attaining a goal greater which would boost Self-Confidence. However, the goal setting would not have as profound an effect on females because females tend to put less of an emphasis on competition and goal-setting and more of an emphasis on health (Flanagan, 2006). The reason why females do not put as much importance on goal setting is because females lack exposure and opportunities in professional sports. Another explanation for the increased Self-Confidence among the 9-10 males could simply be the fact that they were one of the strongest groups in the Skybrook Swim Team Study in terms of performance. These 9-10-year-old males won all of their relays throughout the entire season. On the contrary, the 11-12 females and 13-18 females saw a larger increase among their Self-Confidence scores compared to the 9-10 girls. A possible reason behind older females gaining more Self-Confidence is the fact that females' self-esteem tends to diminish during their transition from a child to a pre-teen (Pedersen, 2004). However,

girls' team sport achievements at a younger age are positively associated with an increase in Self-Confidence during middle to late adolescents. Overall, both males and females showed an increase in Self-Confidence among all groups over the course of the season. However, girls tended to be more confident at older ages while boys tended to be more confident at younger ages.

The fourth QoL measure was Health. As expected, Health increased among all six groups. Health also had five groups who's increases were statistically significant, the most of any QoL measure. A large-scale study on Swiss adolescents found that students who exercise at least twice per week tend to have a higher perception of health as compared to inactive students (Jeannin, 2006). Thus, it makes sense that Skybrook swimmers, who generally practiced four times each week, would show a substantial increase in Health scores. Despite 13-18 males having the least Health score improvement, males, as a whole, showed a larger increase in Health scores. While males improving more than females goes against the belief that females tend to put an extra emphasis on health (Flanagan, 2007), a previous study found that males who seldomly participate in physical fitness, less than three times per month, are 2.22 times as likely to perceive their health as poor (Piko, 2006). However, females who seldomly participate in physical fitness were only 1.15 times as likely to perceive their health as poor. This study shows the extra emphasis that males put on physical fitness's relation to health, and the lessened emphasis that females tend to put on physical fitness's relation to health. This could explain why, despite both sexes completing the same amount of physical activity, males perceived their Health to increase more than females. Youth's sport experience is also greatly affected by their relationship with their coach, as well as the coach's ability to show leadership (Smith, 1996). The oldest Skybrook coach was twenty-one, so the 13-18 males, due to being so close in age, could

have seen the coaches less as authority figures and more as a peer, which could be detrimental to the groups' sense of Health. Overall, the Skybrook Swim Team study reports that a community-driven, structured exercise program, which revolves around the sport of swimming, can have a great effect on children's and adolescents' Health.

The final QoL measure was Happiness. Happiness was tied with Sense of Community for the lowest increase among QoL measures. Happiness was not only the only measure to have zero groups have statistically significant increases, but it was also the only measure to have an entire group, the 13-18 males, average a negative score. Happiness's high level of variability was the reason no group saw a statistically significant increase in their happiness score, despite some groups having a fairly large increase. Compared to the males, females saw a much greater increase in Happiness scores. An older study, which focused specifically on the sport of swimming, found that females are more likely to put an extra emphasis on enjoyment due to their lesser emphasis on competition (Hastings, 1995). Females' tendency to swim for enjoyment could be a reasoning behind their increased Happiness scores. A second more recent study found that sport participation improves happiness among everyone; however, males tend to derive more happiness from sport participation than females (Huang, 2012). The results of the second study do not support the Skybrook Swim Team's results, especially among the 13-18 males. A possible explanation for the 13-18 males' decrease in Happiness score could be their poorer practice attendance. The difference in female's and male's happiness attainment through sport could be an excellent concept for future research.

A limitation of the Skybrook Swim Team study was having a smaller sample size. While sixty-eight swimmers still provide reliable information, a larger sample size would improve the validity of the experiment. Another limitation of the study was the fact that quality of life is

subjective, and all information was collected through surveys, which run the chance of respondents not providing accurate answers or providing answers that put them in a good light (Sauro, 2016). A few children also had questions about Question #5 due to its reverse scoring, despite explaining the reverse scoring of question #5 to everyone before the survey. Confusion on how to respond to this question could have altered the scores of the Physical Fitness QoL measure. The fourth limitation was the fact that Happiness is a tough quality to measure due to its subjective and multifaceted nature, so the zero statistically significant results from the Happiness measure should not be weighted heavily (White, 2018). Finally, all of the subjects came from two neighborhoods of higher socioeconomic status, so results might not generalize to other populations. Future studies should include a more diverse sample of children and adolescents.

Due to the findings in the Skybrook Swim Team Study, I suggest that more community-oriented, structured exercise programs are created during the summer in order to provide countless quality of life and youth development benefits to children across the United States. Club programs should also try to establish a community atmosphere if one does not already exist. The Skybrook Swim Team Study also illuminates how important it is to cater to individual athletes who are part of a larger program. Programs should be structured to tailor to different genders, ages, skill levels, and experience. Possible areas for further research would be implementing a similar program which revolves around a different aerobic-based sport such as running or soccer. It would also be interesting to see how Sense of Community scores would change if a program was twice as long as the Skybrook Swim Team Study. Lastly, another topic for research would be how gender effects happiness attainment through sports. This would be

interesting because The Skybrook Swim Team study's results differ from another study's results (Huang, 2012).

To summarize, quality of life can be significantly increased for children and adolescents by participating in a community-based, structured exercise program revolving around the sport of swimming, particularly in the dimensions of Physical Fitness, Sense of Community, Self-Confidence, and Health. Gender and age also tend to play a large role in the extent to which these benefits are gained.

VI. Appendix

Table 4: Paired T-Test, Stratified by Sex

(a) Total (Skybrook Swim Team)

QoL Measure	Mean
Physical Fitness	0.7500
Sense of Community	0.5809
Self-Confidence	0.8088
Health	0.9265
Happiness	0.5809

(b) Females

QoL Measure	Mean	Std Deviation	T-score	P-value
All Questions	0.7364	1.9146	6.99	<0.0001
Physical Fitness	0.6667	2.0927	2.59	0.0119
Sense of Community	0.6061	1.7964	2.74	0.0079
Self-Confidence	0.8333	1.5648	4.33	<0.0001
Health	0.8182	1.3233	5.02	<0.0001
Happiness	0.7576	2.5903	2.38	0.0205

(c) Males

QoL Measures	Mean	Std Deviation	T-score	P-value
All Questions	0.7229	1.9493	6.94	<0.0001
Physical Fitness	0.8286	1.7691	3.92	0.0002
Sense of Community	0.5571	1.7908	2.59	0.0113
Self-Confidence	0.7857	1.7269	3.81	0.0003
Health	1.0286	1.4139	6.09	<0.0001
Happiness	0.4143	2.7688	1.25	0.2149

Table 5: Multiple Regression, Stratified by Sex, Age-Adjusted (Females)

(a) All Questions (1 – 10)

Age Group	Estimate	Standard Error	T-score	P-value
Nine-Ten	0.7667	0.1568	4.89	<0.0001
Eleven-Twelve	0.7000	0.2147	3.26	0.0012
Thirteen-Eighteen	0.7200	0.1920	3.75	0.0002

(b) Physical Fitness (4 & 5)

Age Group	Estimate	Standard Error	T-score	P-value
Nine-Ten	0.9000	0.3855	2.33	0.0228
Eleven-Twelve	0.3125	0.5279	0.59	0.5560
Thirteen-Eighteen	0.6000	0.4722	1.27	0.2085

(c) Sense of Community (6 & 10)

Age Group	Estimate	Standard Error	T-score	P-value
Nine-Ten	0.6667	0.3306	2.02	0.0480
Eleven-Twelve	0.8750	0.4527	1.93	0.0578
Thirteen-Eighteen	0.3000	0.4049	0.74	0.4615

(d) Self-Confidence (2 & 7)

Age Group	Estimate	Standard Error	T-score	P-value
Nine-Ten	0.7000	0.2893	2.42	0.0184
Eleven-Twelve	0.9375	0.3961	2.37	0.0210
Thirteen-Eighteen	0.9500	0.3543	2.68	0.0094

(e) Health (3 & 8)

Age Group	Estimate	Standard Error	T-score	P-value
Nine-Ten	0.8667	0.2452	3.53	0.0008
Eleven-Twelve	0.8125	0.3358	2.42	0.0184
Thirteen-Eighteen	0.7500	0.3003	2.50	0.0151

(f) Happiness (1 & 9)

Age Group	Estimate	Standard Error	T-score	P-value
Nine-Ten	0.7000	0.4793	1.46	0.1492
Eleven-Twelve	0.5625	0.6563	0.86	0.3947
Thirteen-Eighteen	1.0000	0.5871	1.70	0.0934

Table 6: Multiple Regression, Stratified by Sex, Age-Adjusted (Males)

(a) All Questions (1 – 10)

Age Group	Estimate	Standard Error	T-score	P-value
Nine-Ten	0.8857	0.1644	5.39	<0.0001
Eleven-Twelve	0.8100	0.1944	4.16	<0.0001
Thirteen-Eighteen	0.4364	0.1854	2.35	0.0192

(b) Physical Fitness (4 & 5)

Age Group	Estimate	Standard Error	T-score	P-value
Nine-Ten	0.8214	0.3352	2.45	0.0169
Eleven-Twelve	1.2000	0.3966	3.03	0.0035
Thirteen-Eighteen	0.5000	0.3782	1.32	0.1906

(c) Sense of Community (1 & 9)

Age Group	Estimate	Standard Error	T-score	P-value
Nine-Ten	0.7857	0.3414	2.30	0.0245
Eleven-Twelve	0.3500	0.4040	0.87	0.3894
Thirteen-Eighteen	0.4545	0.3852	1.18	0.2422

(d) Self-Confidence (2 & 7)

Age Group	Estimate	Standard Error	T-score	P-value
Nine-Ten	1.1071	0.3278	3.27	0.0017
Eleven-Twelve	0.5000	0.3879	1.29	0.2018
Thirteen-Eighteen	0.6818	0.3699	1.84	0.0697

(e) Health (3 & 8)

Age Group	Estimate	Standard Error	T-score	P-value
Nine-Ten	1.1786	0.2649	4.45	<0.0001
Eleven-Twelve	1.3000	0.3134	4.15	<0.0001
Thirteen-Eighteen	0.5909	0.2988	1.98	0.0521

(f) Happiness (6 & 10)

Age Group	Estimate	Standard Error	T-score	P-value
Nine-Ten	0.5714	0.5275	1.08	0.2826
Eleven-Twelve	0.7000	0.6241	1.12	0.2661
Thirteen-Eighteen	-0.0455	0.5951	-0.08	0.9393

VII. References

Allen P., Mcelhaney, K. B., Land, D. J., Kuperminc, G. P., Moore, C. W., O'beirne-Kelly, H., & Kilmer, S. L. (2003). A secure base in adolescence: Markers of attachment security in the mother-adolescent relationship. *Child Development, 74*(1), 292-307. doi:10.1111/1467-8624.t01-1-00536

Asthana H. (2012). PSYCHO-SOCIAL CORRELATES OF OBESITY. *Social Science International, 28*(2), 233-251.

Balint, E., Szabo, P., Marshall, C., & Sprague, S. (2001). Glucose-induced inhibition of in VITRO bone mineralization. *Bone, 28*(1), 21-28. doi:10.1016/s8756-3282(00)00426-9

Bastiaansen, D., Koot, H. M., & Ferdinand, R. F. (2005). Determinants of quality of life in children with psychiatric disorders. *Quality of Life Research, 14*(6), 1599-1612. doi:10.1007/s11136-004-7711-2

Brazendale, K., Beets, M. W., Turner-Mcgrievy, G. M., Kaczynski, A. T., Pate, R. R., & Weaver, R. G. (2018). Children's obesogenic behaviors during summer versus school: A within-person comparison. *Journal of School Health, 88*(12), 886-892. doi:10.1111/josh.12699

Brazendale, K., Beets, M. W., Weaver, R. G., Pate, R. R., Turner-Mcgrievy, G. M., Kaczynski, A. T., . . . Hippel, P. T. (2017). Understanding differences between summer vs. SCHOOL obesogenic behaviors of children: The structured DAYS HYPOTHESIS. *International Journal of Behavioral Nutrition and Physical Activity, 14*(1). doi:10.1186/s12966-017-0555-2

Bridger, T. (2009). Childhood obesity and cardiovascular disease. *Paediatrics & Child Health, 14*(3), 177-182. doi:10.1093/pch/14.3.177

Buote, V. (2016, May 11). Most employees feel authentic at work, but it can take a while. Retrieved April 27, 2020, from https://hbr.org/2016/05/most-employees-feel-authentic-at-work-but-it-can-take-a-while

CDC. (2017, March 17). FastStats - leading causes of death. Retrieved February 27, 2020, from https://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm

Caldwell L., & Smith, E. A. (2006). Leisure as a context for youth development and delinquency prevention. *Australian & New Zealand Journal of Criminology, 39*(3), 398-418. doi:10.1375/acri.39.3.398

Coon A., Goldberg, J., Rogers, B. L., & Tucker, K. L. (2001). Relationships between use of television during meals and children's food consumption patterns. *Pediatrics, 107*(1). doi:10.1542/peds.107.1.e7

Danish S.J., Taylor, T. E., & Fazio, R. J. (2006). Enhancing adolescent development through sports and leisure. *Blackwell Handbook of Adolescence,* 92-108. doi:10.1002/9780470756607.ch5

Danish, S.J., Hodge, K., & Heke, I. (in press). Promoting healthy development of youth through physical activity and sport. *In T. P. Gullota & Bloom (Eds.), Encyclopedia of Primary Prevention.*

Eddolls, W. T., Mcnarry, M. A., Lester, L., Winn, C. O., Stratton, G., & Mackintosh, K. A. (2018). The association between physical activity, fitness and body mass index on mental well-being and quality of life in adolescents. *Quality of Life Research, 27*(9), 2313-2320. doi:10.1007/s11136-018-1915-3

Eime M., Harvey, J. T., Sawyer, N. A., Craike, M. J., Symons, C. M., Polman, R. C., & Payne, W. R. (2013). Understanding the contexts of adolescent female participation in sport and physical activity. *Research Quarterly for Exercise and Sport, 84*(2), 157-166. doi:10.1080/02701367.2013.784846

Fernández, I., Canet, O., & Giné-Garriga, M. (2016). Assessment of physical activity levels, fitness and perceived barriers to physical activity practice in adolescents: Cross-sectional study. *European Journal of Pediatrics, 176*(1), 57-65. doi:10.1007/s00431-016-2809-4

Flanagan, K., Baker, C., Fortin, M., & Tinsley, D. (2006). The effect of Gender opportunity in sports on the priorities and aspirations of young athletes. *The Sports Journal*.

Frost, H. (1997). Obesity, and bone strength and "mass": A tutorial based on insights from a new paradigm. *Bone, 21*(3), 211-214. doi:10.1016/s8756-3282(97)00124-5

Garcia Bengoechea, E., & Strean, W. (2001). Fun in youth sport: Perspectives from coaches' conceptions and participants' experiences. *Paper Presented at the Association for the Advancement of Applied Sport Psychology*.

Gattino, S., Piccoli, N. D., Fassio, O., & Rollero, C. (2013). Quality of life and sense of community. a study on health and place of residence. *Journal of Community Psychology, 41*(7), 811-826. doi:10.1002/jcop.21575

Hamburg, M. (2014). School lunches, FDA approval process: Objections. Retrieved April 08, 2020, from https://www.usatoday.com/story/opinion/2014/06/05/school-nutrition-beverages-fda-process-your-say/10040729/

Hastings, W., Kurth, S. B., Schloder, M., & Cyr, D. (1995). Reasons for participating in a Serious LEISURE CAREER: Comparison of Canadian and U.S. Masters Swimmers. *International Review for the Sociology of Sport, 30*(1), 101-119. doi:10.1177/101269029503000106

Hicks, A., & Rozette, E. (1986). Habitual sleep duration and eating disorders in college students. *Perceptual and Motor Skills, 62*(1), 209-210. doi:10.2466/pms.1986.62.1.209

Hippel, T., & Workman, J. (2016). From kindergarten through second GRADE, U.S. CHILDREN'S OBESITY Prevalence grows only during summer vacations. *Obesity, 24*(11), 2296-2300. doi:10.1002/oby.21613

Hippel, T., Powell, B., Downey, D. B., & Rowland, N. J. (2007). The effect of school on overweight In Childhood: Gain in body mass index during the school year and during summer vacation. *American Journal of Public Health, 97*(4), 696-702. doi:10.2105/ajph.2005.080754

Huang, H., & Humphreys, B. R. (2012). Sports participation and Happiness: Evidence from US MICRODATA. *Journal of Economic Psychology, 33*(4), 776-793. doi:10.1016/j.joep.2012.02.007

Jeannin, A., Suris, J., & Michaud, P. (2006). Correlates of extracurricular sport participation among swiss adolescents. *European Journal of Pediatrics, 165*(8), 546-555. doi:10.1007/s00431-006-0129-9

Karacabey, K., Saygin, O., Ozmerdivenli, R., Zorba, E., Godekmerdan, A., & Bulut, V. (2005). The effects of exercise on the immune system and stress hormones in sportswomen. *Neuroendocrinology Letters, 26*(4), 361-366. doi:0172–780X

Kelinske, B., Mayer, B., & Chen, K. (2001). Perceived benefits from participation in sports: A gender study. *Women in Management Review, 16*(2), 75-84. doi:10.1108/09649420110386601

Kim, B., Choi, D., Jung, C., Kang, S. K., Mok, J., & Kim, C. (2017). Obesity and physical activity. *Journal of Obesity and Metabolic Syndrome, 26*(1), 15th ser., 15-22. doi:10.7570/jomes.2017.26.1.15

Kirov, R., & Brand, S. (2011). Sleep and its importance in adolescence and in common adolescent somatic and psychiatric conditions. *International Journal of General Medicine, 4*, 425-442. doi:10.2147/ijgm.s11557

Kleiber, A., & Kirshnit, C. E. (2019). Sport involvement and identity formation. *Mind-Body Maturity,* 193-212. doi:10.4324/9781315792194-14

Kullowatz, A., Kanniess, F., Dahme, B., Magnussen, H., & Ritz, T. (2007). Association of depression and anxiety with health care use and quality of life in asthma patients. *Respiratory Medicine, 101*(3), 638-644. doi:10.1016/j.rmed.2006.06.002

Kumar, A., Rossiter, P., & Olczyk, A. (2009). Children's participation in organised sporting activity. *Australian Bureau of Statistics,* 1-40. doi:1351.0.55.028

La Torre, G., Mannocci, A., Saulle, R., Sinopoli, A., D'Egidio, V., Sestili, C. . . . Masala, D. (2017). Improving knowledge and behaviors on diet and physical activity in children: Results of a pilot randomized field trial. *Ann Ig, 29*, 584-594. doi:10.7416/ai.2017.2187

Martinsen, D., Neumer, S., Holen, S., Waaktaar, T., Sund, A. M., & Kendall, P. C. (2016). Self-reported quality of life and self-esteem in sad and anxious school children. *BMC Psychology, 4*(1). doi:10.1186/s40359-016-0153-0

McCue, M., Marlatt, K., Sirard, J., & Dengel, D. (2013). Examination of Changes in Youth Diet and Physical Activity Over the Summer Vacation Period. *The Internet Journal of Allied Health Sciences and Practice, 11*(1).

Nixon, M., Thompson, J. M., Han, D. Y., Becroft, D. M., Clark, P. M., Robinson, E., . . . Mitchell, E. A. (2008). Short sleep duration in middle childhood: Risk factors and consequences. *Sleep, 31*(1), 71-78. doi:10.1093/sleep/31.1.71

Ogden, L., Carroll, M. D., Lawman, H. G., Fryar, C. D., Kruszon-Moran, D., Kit, B. K., & Flegal, K. M. (2016). Trends in OBESITY prevalence among children and adolescents in the United States, 1988-1994 THROUGH 2013-2014. *Jama, 315*(21), 2292. doi:10.1001/jama.2016.6361

Olds, S., Maher, C. A., & Matricciani, L. (2011). Sleep duration or bedtime? Exploring the relationship between sleep habits and weight status and activity patterns. *Sleep, 34*(10), 1299-1307. doi:10.5665/sleep.1266

Parhami, F., Morrow, A. D., Balucan, J., Leitinger, N., Watson, A. D., Tintut, Y., . . . Demer, L. L. (1997). Lipid oxidation products have opposite effects on calcifying vascular cell and bone cell differentiation. *Arteriosclerosis, Thrombosis, and Vascular Biology, 17*(4), 680-687. doi:10.1161/01.atv.17.4.680

Patriarche, C. (2009, November 16). 6 ways to build a sense of community. Retrieved April 27, 2020, from https://www.sheknows.com/living/articles/812171/6-ways-to-build-a-sense-of-community/

Pedersen, S., & Seidman, E. (2004). Team sports achievement and self-esteem development among Urban adolescent girls. *Psychology of Women Quarterly, 28*(4), 412-422. doi:10.1111/j.1471-6402.2004.00158.x

Petrescu, S. (2013). SCIENTIFIC ARGUMENTS REGARDING THE INCREASE OF THE QUALITY OF ADULTS LIFE THROUGH THE PRACTICE OF SWIMMING. *Discobolul - UNEFS Journal of Culture, Education, Sports, and Physiotherapy, 9*(3), 33rd ser., 50-56.

Piko, F. (2006). Self-perceived health among adolescents: The role of gender and psychosocial factors. *European Journal of Pediatrics, 166*(7), 701-708. doi:10.1007/s00431-006-0311-0

Pollock, N. K. (2016). Childhood obesity, bone development, and cardiometabolic risk factors. *Moll Cell Endocrinol, 410,* 52-63. doi:10.1016/j.mce.2015.03.016.

Reid, J., Baron, K. G., Lu, B., Naylor, E., Wolfe, L., & Zee, P. C. (2010). Aerobic exercise improves self-reported sleep and quality of life in older adults with insomnia. *Sleep Medicine, 11*(9), 934-940. doi:10.1016/j.sleep.2010.04.014

Rodríguez, A., Winkleby, M. A., Ahn, D., Sundquist, J., & Kraemer, H. C. (2002). Identification of population subgroups of children and adolescents with high asthma prevalence. *Archives of Pediatrics & Adolescent Medicine, 156*(3), 269. doi:10.1001/archpedi.156.3.269

Ross, E. (1994). Overweight and depression. *Journal of Health and Social Behavior, 35*(1), 63. doi:10.2307/2137335

S.J., D. (2000). Youth and community development: How after-school programming can make a difference. *In S.J. Danish, & T. P. Gullotta (Eds.), Developing Competent Youth and Strong Communities through After-school Programming.*

Sauro, J. (2016, September 27). 9 biases that Affect survey responses. Retrieved May 01, 2020, from https://measuringu.com/survey-biases/

Sisson, B., Broyles, S. T., Baker, B. L., & Katzmarzyk, P. T. (2010). Screen time, physical activity, and overweight in u.s. youth: National survey of children's health 2003. *Journal of Adolescent Health, 47*(3), 309-311. doi:10.1016/j.jadohealth.2010.02.016

Smith, F., & Smoll, R. (1996). *Children and youth in sport: A biopsychological perspective*. Madison, WI: Brown and Benchmark.

Subramanian, K., Sharma, V., Arunachalam, V., Radhakrishnan, K., & Ramamurthy, S. (2015). Effect of structured and unstructured physical activity training on cognitive functions in adolescents – a randomized control trial. *Journal Of Clinical And Diagnostic Research, 9*(11). doi:10.7860/jcdr/2015/14881.6818

Swift, D. L., Lavie, C. J., Johannsen, N. M., Arena, R., Earnest, C. P., O^|^rsquo;keefe, J. H., . . . Church, T. S. (2013). Physical activity, Cardiorespiratory fitness, and exercise training in primary and Secondary coronary prevention. *Circulation Journal, 77*(2), 281-292. doi:10.1253/circj.cj-13-0007

Taheri, S., Lin, L., Austin, D., Young, T., & Mignot, E. (2004). Short sleep duration is associated with reduced leptin, elevated ghrelin, and increased body mass index. *PLoS Medicine, 1*(3). doi:10.1371/journal.pmed.0010062

Tapp, H., Mcwilliams, A., Dulin, M., & Mohanan, S. (2014). Obesity and asthma: Pathophysiology and implications for diagnosis and management in primary care. *Experimental Biology and Medicine, 239*(11), 1531-1540. doi:10.1177/1535370214525302

Taylor, T. E., Fazio, R. J., & Danish, S. (2006). Enhancing adolescent development through sports and leisure. *Blackwell Handbook of Adolescence,* 92-108. doi:10.1002/9780470756607.ch5

Valois, F., Zullig, K. J., Huebner, E. S., & Drane, J. W. (2004). Physical activity behaviors and perceived life satisfaction among public high school adolescents. *Journal of School Health, 74*(2), 59-65. doi:10.1111/j.1746-1561.2004.tb04201.x

Verhulst, L., Gaal, L. V., Backer, W. D., & Desager, K. (2008). The prevalence, anatomical correlates and treatment of sleep-disordered breathing in obese children and adolescents. *Sleep Medicine Reviews, 12*(5), 339-346. doi:10.1016/j.smrv.2007.11.002

White, M. D. (2018). The problems with measuring and using happiness for policy purposes. *SSRN Electronic Journal*. doi:10.2139/ssrn.3191385

Yin, S., Njai, R., Barker, L., Siegel, P. Z., & Liao, Y. (2016). Summarizing health-related quality of life (HRQOL): Development and testing of a ONE-FACTOR MODEL. *Population Health Metrics, 14*(1). doi:10.1186/s12963-016-0091-3

Yorks, M., Frothingham, C. A., & Schuenke, M. D. (2017). Effects of group fitness classes on stress and quality of life of medical students. *The Journal of the American Osteopathic Association, 117*(11), 17-25. doi:10.7556/jaoa.2017.140

Zarrett, N., Fay, K., Li, Y., Carrano, J., Phelps, E., & Lerner, R. M. (2009). More than child's play: Variable- and pattern-centered approaches for examining effects of sports participation on youth development. *Developmental Psychology, 45*(2), 368-382. doi:10.1037/a0014577

Štefan, L., Paradžik, P., & Sporiš, G. (2019). Sex and age correlations of reported and estimated physical fitness in adolescents. *Plos One, 14*(7). doi:10.1371/journal.pone.0219217